PROTOCOLS FOR INJURIES TO THE FOOT

FOOT FRACTURES (DIGITAL)

A. Background

Digital fractures occur frequently in the workplace and in a variety of fashions ranging from the relatively simple non-displaced fracture of the 5th toe to the significantly more damaging intra-articular great toe fracture.

Modes of occurrence usually fall into stubbing or trauma from a falling object. The occurrence of all of these injuries is reduced significantly by wearing of "safety shoes".

B. Diagnostic Criteria

1. Pertinent Historical and Physical Findings:

Typically the patient complains of pain, edema, and erythema as well as difficulty in wearing certain shoe gear and pain on ambulation. Symptoms are easily reproducible by palpation of the affected part.

2. Appropriate Diagnostic Tests and Examinations.
   A. Standard radiographs in A.O., lateral and medial obligue projections.

C. Varieties

1. Fracture Lesser Digit (i.e., 2nd - 5th toes)

A. Non Articular Phalanx Fractures

Treatment

1. Non-displaced (most common)
   a. Buddy splint and fracture shoe for 4 weeks

2. Displaced (less common)
a. Closed reduction (with local anesthetic block if necessary) followed with Buddy splint and fracture shoe for 4 - 6 weeks.
b. Open (rare) with prior authorization
Return to modified work when able.

B. Intra Articular Proximal Phalanx Fractures

Treatment: Displaced or non-displaced

Closed reduction

To restore digital alignment followed by a Buddy splint and fracture shoe for 4 weeks.
Return to modified work when able.

2. Fracture of the Great Toe

A. Varieties

I. Simple Non Communited Fracture Distal Tuft

Treatment

1. Reduce subungual hematoma when present, either by nail puncture or removal.
2. Fracture shoe for 4 weeks.
3. Return to work when able, modified duty, up to 4 weeks.

II. Communited Fracture Distal Tuft

Treatment

Closed - Removal or puncture of nail plate to relieve subungual hematoma. Follow with a fracture shoe for 4 weeks.

Treatment

Open

1. Appropriate tetanus prophylaxis and antibiotics

2. Open reduction in O.R. to debride necrotic tissue, all loose and exposed bone. Followed by fracture shoe for 4 - 6 weeks.

Return to work, modified duty, when able.

III. Intra Articular Dorsal Avulsion Fracture of Distal Phalanx Base (EHL Avulsions)

Treatment

A. Displaced (more common)
Open reduction with necessary internal fixation.
Followed by fracture or short leg cast for 4 - 6 weeks.

B. Non-displaced
Fracture shoe for 4 weeks
Return to work, modified duty, when able.

IV. Great Toe Intra Articular Fractures of the Distal or Proximal Phalanx

Treatment

A. Non-displaced

Buddy splint, fracture shoe for 4 weeks.

B. Displaced

1. Attempt closed reduction first - follow with Buddy splint and fracture shoe for 4 weeks.

2. Open when alignment of articular surfaces fail.

Follow with fracture shoe for 4 - 6 weeks.

Return to work, modified duty, when able.

V. Great Toe Proximal Phalanx Fracture

Treatment

A. Displaced

1. Closed reduction with or without percutaneous pinning followed by Buddy splint and fracture shoe for 4 weeks.

B. Non-displaced

1. Buddy splint and fracture shoe for 4 weeks

Return to work, modified duty, when able.

VI. Great Toe - First MTP Intra Articular Condylar Fractures of the Proximal Phalanx

A. Displaced

Treatment

Open reduction with appropriate internal fixation. Smaller bone fragments excised and intrinsic musculature reattached as necessary followed by fracture shoe for 4 - 6 weeks.

B. Non-displaced

Treatment

Buddy splint and fracture shoe for 4 weeks.

Return to work, modified duty, when able.

SUMMARY

Most digital fractures occur from blunt trauma or stubbing. Extent of injury and disability established by force created by stubbing. Duration of treatment has been established for most common forms of digital fractures; however, the nature of patient's occupation will sometimes allow for return to work before the fracture treatment is completed. It must be established by the treating physician whether or not a return to work will delay healing or put the worker at risk for further injury. Often times a change to a temporary seated job will allow for more rapid return to the workplace.

Estimated Duration of Care

1. Non-displaced digital fracture - 4 weeks

2. Displaced digital fracture treated by open reduction internal fixation - 4 - 6 weeks

Return to work, modified duty, when able.

METATARSAL FRACTURES

Background

Metatarsal fracture can be defined as a break in the structural continuity of one or more of the five metatarsals of either foot. These are long bones, and fracture may occur at the head, neck, shaft, or base. Fracture at a joint surface (intra-articular or osteochondral) may occur as well. They may be classified as open or closed, displaced or non-displaced, simple or communited. A stress or fatigue fracture may occur as well. It is common for metatarsal fractures to be evaluated and treated by category as follows: First Metatarsal, Central (2-3-4) Metatarsal, Fifth Metatarsal, Fifth Metatarsal Jones Fracture, Fifth Metatarsal Proximal Avulsion Fracture, and Osteochondral Fracture.

Typically, metatarsal fractures occur secondary to direct injury or blunt trauma. Examples include dropping a heavy object, kicking a hard surface, or crush injury. However, these fractures may result from indirect trauma, i.e., fall or misstep. Additionally, a stress or fatigue fracture can occur usually of insidious onset from repetitive microtrauma, i.e., overuse of a foot pedal.

Occurrence is variable and not particular to gender or age group. Open fractures and those involving multiple sites are rare. The use of industrial footwear and varied terrain floor surfaces offer protection.

Diagnostic Criteria

A. Pertinent History and Physical Findings

Metatarsal fracture is typically episodic and has an acute onset. It is recognized as a traumatic occurrence and presents with immediate signs and symptoms. An exception would be the stress or fatigue fracture. An accurate history including mechanism of injury, work activity and footwear is vital.

Typically, pain is instantaneous. Localized swelling begins immediately and gradually progresses in a generalized fashion. Patients demonstrate altered weight bearing accompanied by an antalgic gait. A limp often marked by an abducted foot position is marked by a loss in propulsive ability.

Examination reveals maximum tenderness directly over the fracture site with associated swelling. Generalized pain and edema are noted in radial fashion. A hematoma is observed at times. Patients often manifest muscular splinting or guarding. Neurovascular compromise is more common with crush injuries, open fractures, or severely displaced bone fragments. Neurovascular assessment should be made periodically. Crepitus may be palpable at the fracture site as well as an appreciation of fragment displacement. Digital displacement can be noted; and joint pain and/or limited range of motion is common with intra-articular involvement.

B. Appropriate Diagnostic Tests

1. Radiographs of Foot: Routine, minimum of two views. Comparison films of contralateral foot not routinely needed. May repeat ten to twenty-one days later in case of stress fracture.

2. Bone Scan: Not routine. Appropriate when pertinent historical and physical findings yield high index of suspicion with questionable or negative radiograph findings, i.e., stress fracture.

3. CT Scan: Not routine. Appropriate to confirm intra-articular involvement and extent with positive radiographic or bone scan findings. May be appropriate when negative bone scan findings contradict overwhelming pertinent historical and physical findings.

4. M.R.I.: Not routine. May be appropriate when above-mentioned tests fail to confirm fracture presentation despite overwhelming pertinent historical and physical findings along with recalcitrance of injury to four to six weeks of conservative treatment, including immobilization.

TREATMENT

A. Outpatient

1. Non-Operative

a. Indications: Mild-moderate symptoms. Pregnancy. Closed, stable fracture without significant risk of fragment displacement.

b. Supportive Care (may include): Initial use of splint (posterior) with Jones type compressive dressing until edema resolves. NSAID Rx. Narcotic analgesic (oral) Rx for five to seven days.

1. Non-displaced - Appropriate immobilization.

2. Displaced - Closed reduction with immobilization.

c. Treatment Options: Closed reduction manipulation (with or without regional anesthesia and/or sedation) and immobilization.

d. Immobilization Options:

1. Stiff soled medical/surgical shoe (given postoperative):

Commonly utilized with stable isolated fractures of central or fifth metatarsals as well as in later stages of fracture repair following an earlier period of cast immobilization. May be combined with a slipper type cast or compressive type dressing (Unna boot, Gelcast). Frequently used for stress fractures.

2. Cast immobilization (short leg): Considered a universal modality in fracture immobilization. May be represented as removable cast like synthetic walker. Nonweightbearing (NWB) cast typically recommended for fractures of the first metatarsal, multiple, following open reduction and internal fixation (O.R.I.F.), following percutaneous pinning, unstable fractures, osteochondral fractures, and Jones fractures.

e. Fracture Locations

1. First metatarsal (neck, shaft, base): Closed reduction followed by immobilization of six weeks.

2. Central metatarsal (neck, shaft, base): Closed reduction followed by immobilization of six weeks.

3. Fifth metatarsal (neck, shaft): Closed reduction followed by immobilization of six weeks.

4. Fifth metatarsal - Jones Type: Closed reduction followed by immobilization of eight weeks.

5. Fifth metatarsal - Proximal Avulsion: Closed reduction followed by immobilization of six weeks.

6. Osteochondral/Intra-articular: Closed reduction followed by immobilization of six weeks.

7. Stress/Fatigue: Closed reduction followed by immobilization of four weeks.

f. Rehabilitation

1. Appropriate physical therapy modalities.

2. Operative

a. Indications: Displaced fracture fragments nonreducible despite closed reduction attempts. Major avulsion of bone. Multiple fragments. Significant instability of fragments. Intra-articular displacement.

b. Supportive Care: (May include, in addition to above-mentioned item): Antibiotic Prophylaxis

c. Treatment Options: Percutaneous pinning or open reduction internal fixation (O.R.I.F.) and immobilization.

d. Immobilization Options: As noted above.

e. Rehabilitation: As noted above.

B. Inpatient Treatment (Not common)

a. Indications: Crush injury with moderate-severe soft tissue damage. Open fracture. Multiple fractures. Demonstrated need for neurovascular monitor, i.e., questionable distal tissue viability, impending compartment syndrome. Post-operative admission is appropriate to monitor edema, neurovascular status; or to deliver parenteral analgesia.

b. Supportive Care: (May include, in addition to above-mentioned items): Parenteral antibiotics, neurovascular monitor, parenteral analgesics, infectious disease consult, vascular consult, wound packing/ debridement.

c. Treatment Options: Splintage, wound irrigation and debridement. O.R.I.F. (with alternative use of external fixator). NWB cast immobilization/NWB splint with wound access for inspection. Dressing application and wound packing. Delayed primary closure.

d. Rehabilitation: As noted above after eradication of infection if present and wound stabilization/closure.

ACUTE SOFT TISSUE INJURIES

I. Background

Ankle injuries can occur due to an irregular surface, poor shoe gear, or misstep. Injuries to the lateral (outside) ligaments are the most common and can present with very little evidence of injury other than acute swelling and pain and difficulty walking. Injuries to medial (inside) ligaments are less common. Radiographs may be negative and the extent of soft tissue injury to either side is very difficult to define. Chronic instability can be very common if ankle injuries are not treated appropriately initially.

II. Diagnostic Criteria

A. Medial Collateral Ligament Sprain/Rupture

1. Mechanism of Injury: Signs and Symptoms

Medial injuries; solitary injury to the medial ligaments, (deltoid ligament) is uncommon or rare. Usually associated with other injuries to other ligaments and/or fracture. Most common associated injuries are fractures of the fibular and ruptures of the tibial fibular syndesmosis. The force applied to the foot to cause this injury is an external rotation abductory force. Rupture of the deltoid ligament will cause pain and swelling on the medial and anterior aspects of the ankle. There will be tenderness on palpation of the ligament and a palpable defect may pinpoint which ligaments are involved. The fact that a rupture of the deltoid ligament is usually associated with

other injuries, the usual presentation is that of a completely edematous and ecchymotic ankle that is being held in a splinted position.

2. Diagnostic Evaluation

Radiographs AP, lateral, mortise, and a high fibular view. Clinical exam should include range of motion, lateral and rotatory movement of the talus in relation to the tibia and anterior/posterior displacement of the ankle. A frankly unstable ankle is easily recognized, but there is not a reliable clinical means of assessing ankles with intermediate degrees of instability. These injuries can be evaluated with a stress x-ray which may be done by hand or with a Telos apparatus. This is done with a mortise view of the ankle where the foot is abducted and everted in relation to the leg, and a lateral view where the foot is anteriorly displaced in relation to the leg. Stress views are done bilaterally and compared to the injured site. In the mortise view the amount of clear space between the talus and medial malleolus is what is evaluated. A clear space of 1cm or greater is diagnostic for rupture of the deltoid ligament. Further diagnostic studies could include arthrography. MRI is the most specific for ligament rupture and partial rupture.

B. Lateral Collateral Ligament Sprain or Rupture

1. Anatomy

The lateral collateral ligaments are comprised of three distinct ligaments which do not reinforce each other as do the deltoid ligaments. The anterior talo fibular ligament is triangular or fan shaped intracapsular, considered the primary stabilizer of the ankle. Calcaneal fibular ligament is rather narrow and cord-like lying extracapsular just beneath the peroneal tendon sheath. The posterior talo fibular ligament is thicker and stronger than the other two and intracapsular. It is the least injured.

2. Mechanism of Injury Signs and Symptoms

The most common mechanism injury is inversion and plantar flexion of the foot relative to the ankle which

will distort or rupture the anterior talo fibular ligament. If the inversion portion is severe enough, then the calcaneal fibular ligament will be also damaged. In some rare instances, only a true inversion maneuver of the calcaneal fibular ligament may be singularly distorted or ruptured. Depending upon the severity of forces producing the injury, the time span since the injury and initial self-treatment, one may encounter a variety of signs and symptoms. Usually the pain and inability to place weight on the injured ankle will cause the patient to seek medical care. The amount of edema or ecchymosis is <u>not</u> a good indicator as to the extent of ligamentous rupture.

3. Diagnostic Evaluation

After careful history of the injury and performing clinical examination of the foot and lower leg with palpation along the course of each of the tendonous structures and bony structures around the ankle. Anterior lateral along the course of the anterior talo fibular ligament, calcaneal fibular and posterior fibular. Also, palpation of the posterior ankle should be carried out and evaluation of the Achilles tendon and the integrity of the fibular. The ankle also needs to be evaluated for rupture of the tibial fibular ligament and must be checked for possible diastasis. Other injuries associated with ankle is fracture of the 5th metatarsal, anterior superior process of the calcaneus and the posterior lateral tubercle of the talus.

Further studies for chronically unstable ankles or the recurrent ankle sprain would be stress views, inversion stress and push/pull which must be performed bilaterally. The injured ankle must be adequately anesthetized prior to performing these maneuvers in order to prevent peroneal tendons from going into spasm. Common peroneal nerve block or local ankle infiltration seems to work the best. Using Telos equipment for the stress views allows more reproducible date and reduced radiation exposure to the examiner. A 5-6 degree angular difference between the injured and uninjured ankle signifies the ligamentous rupture. Push/pull stress test or the anterior draw signs specifically evaluates the integrity of the anterior talo

fibular ligament. MRI would be the diagnostic procedure of choice or ankle joint arthrography if MRI is not available.

III. Treatment for Ankle Instability and Injury

A. Meticulous replacement or repair of the deltoid ligament does not appear to be essential, and in most instances involving fibular fracture the ruptured deltoid does not need to be repaired if the lateral side was anatomically and rigidly fixed. Surgical repair of the deltoid ligament is clearly indicated if closed reduction does not replace the talus into its proper position. This could occur if the deltoid ligament rolled up or inverted, or if the posterior tibial tendon was trapped. If closed reduction or operative repair of the deltoid ligament is required, the patient is placed in a non-weight-bearing below-the-knee cast for 3-6 weeks. This is followed by a weight-bearing cast below the knee for another 3-6 weeks. Total casting regime could range from 6-12 weeks depending on the individual. In the case of non-operative repair, usual casting would be for approximately three weeks with splinting for another 3-6 weeks with vigorous physical therapy at that point for 3-4 weeks to build up strength in the affected extremity.

B. Treatment for acute lateral collateral ligament distortion, sprain, or true ruptures, are dependent on several factors;

1. How acute, painful, or symptomatic;
2. Negative stress x-rays, ankle MRI, or arthrogram;
3. History of chronic instability;
4. Patients with significant medical history which would contraindicate any more definitive therapy;
5. Patients who lead a sedentary lifestyle;
6. Patients who present for treatment 3-4 weeks following the traumatic episode.

The literature is significantly divided as to the success of surgical intervention vs. conservative treatment with immobilization for ligament rupture. Patients treated conservatively must be forewarned that treatment is aimed

only at relieving the signs and symptoms and that the ankle may still be prone to some instability and especially if the ligament is ruptured. For younger, very active patients, more aggressive therapy would be more appropriate.

Initial therapy should consist of:

Compression cast,
Non-weight bearing,
Elevation,
Ice therapy,
Non-steroidal medications.

Patients should be reevaluated approximately 3-4 days following the injury, if there is a marked decrease in symptoms, discomfort, this is a first time injury and upon exam the ankle appears stable, then follow up should consist of splinting or bracing and exercise program for 4 weeks.

If there is no significant improvement, further evaluation and treatment is necessary.

1. Short leg weight bearing cast is applied. Length of casting will vary from 2 - 4 weeks. If testing reveals the osseous and soft tissue structures are intact, then treatment should be centered around combination of stabilizing ankle and aggressive exercise program.

If testing reveals ligamentous rupture, then one must weigh pros and cons of surgical intervention versus conservative immobilization therapy.

For the compliant sedentary patient, one would suggest casting for 3 weeks, then follow up with air cast type splint for approximately 6 weeks.

For the active patient, primary surgical repair should be recommended. This type surgery should be performed after the edema and ecchymosis are under control, if possible a primary repair should be performed within the first 2-3 days following traumatic episode. However, the

literature has shown that the primary repair can be effective as much as 6-12 months after trauma. Follow up includes approximately 3 weeks non-weight bearing immobilization, then 3 weeks weight bearing, then 4 weeks of air cast type splinting. Long-term control and stability of the ankle can be achieved with functional orthomechanical braces in the shoes.

Physical therapy modalities are also utilized to regain full use and strength and improve the proprioceptive activity of the muscle and function of the ankle, for both classes of patients.

For the patient with chronic ankle pain due to multiple ankle injuries or poorly treated ankle injury, proper diagnosis and treatment are necessary to return the patient to normal pain-free activity. Proper identification and diagnosis etiology of pain is imperative to identify which ligaments structures joints are involved so that proper therapeutic modalities can be instituted.

Evaluation is similar to acute injuries consisting of;

1. radiographs,
2. clinical exam,
3. MRI,
4. diagnostic arthroscopy (rare, prior authorization required),
5. injection therapy,
6. physical rehabilitation,
7. surgical intervention with ligamentous reconstruction.

PROTOCOL HISTORY:
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